

# 2007 University of Puerto Rico Research Plan of Work

## Brief Summary about Plan of Work

### PLAN OVERVIEW

The University of Puerto Rico Agricultural Experiment Station (AES) mission within the College of Agricultural Sciences (CAS) is to conduct scientific research that promotes an economically viable agricultural sector, the conservation and enhancement of natural resources and the environment, and a better quality of life in rural and urban areas. Our research also supports the industries that process agricultural raw materials and provides the technological base required for solving the problems affecting farmers, public and private institutions, and for rural development. The AES coordinates its academic activities with the teaching and extension faculty of the CAS, and incorporates into its research program faculty of these other two institutional branches. Although for this Plan of Work (POW) cycle, the AES and the Puerto Rico Agricultural Extension Service have opted to continue with separate submissions, all of our planned programs incorporate the collaboration of Extension faculty in the activities proposed to disseminate results, and many also extend this collaboration to other key aspects of the research process.

The AES has administrative offices and carries out research activities at two main centers: Río Piedras, in the northern San Juan metropolitan area, and Mayagüez, on the west coast of the island, where the CAS Campus is located. In addition, the AES has six substations comprising more than 2,000 acres of land distributed in the different geographical and ecological zones of Puerto Rico. This wide distribution allows for the evaluation of crop and animal production systems adapted to the conditions of different ecological zones. In addition, to advance regional goals, the AES participates in both multistate research and Special Grants from USDA-CSREES that target agriculture in the Caribbean Basin of the United States.

This POW incorporates the input that stakeholders have provided in the yearly meetings of commodity areas or in workshops and field days, on the major problems and research priorities that should be targeted by our program. As before, we have continued to celebrate these annual meetings in which the progress of projects is discussed, preliminary results are shared, and further input is sought for updating the commodity's research needs and priorities. All of our project proposals, formula funded or otherwise, go through a thorough merit review process following the Administrative Manual for the Hatch (Experiment Station) Act as Amended. Last year, however, we changed the way in which our Hatch-funded research proposals are initially granted. In response to internal and external evaluations requesting that a portion of Hatch funds be allocated to projects on the basis of an annual call for proposals with the year's revised priorities, part of our formula-funded research is now locally competitively granted.

In contrast with most mainland states, in Puerto Rico the links between agriculture and food were gradually severed during the second half of the 20th century. As agriculture lagged behind the growth of other economic sectors such as manufacture, service and government, the expanded consumption of the population was gradually supplied by imports, distributed mostly through large supermarket chains. By 2004 the agricultural sector's contribution to the Gross Domestic Product was less than 1%, even though there have been increased investments by the government in the sector during the last five years. Overall figures, however, do little to convey the continued vital role played by farming in the economy of Puerto Rico in terms of fostering demand for other final and intermediate goods, creating employment in areas where alternative opportunities do not abound, supplying produce for domestic consumption and local processing plants, and preserving the island's natural resources from alternative urban uses--potentially more damaging to a fragile tropical-island ecosystem. The University Of Puerto Rico College Of Agricultural Sciences, through its research and education programs, has been an important contributor to the development of enterprises that have had a positive impact on the island's economy. Through technologies that improve and promote diversified agricultural production systems, the CAS has also helped halt the decline that the collapse of traditional operations, sugar and tobacco among others, has had over the agricultural system in general.

Current trends in global markets and the challenges they pose to the continued viability of food and agroindustrial operations in Puerto Rico, underline even more the role that a responsive research program can play in the search for alternatives to the needs of stakeholders. Although the North American (NAFTA) and Central American-Dominican Republic Free Trade Agreements (CAFTA-DR) have up to now exempted Puerto Rico from its market pricing policies, it is unclear whether these exemptions will expire in the near future, and how they will affect our agricultural sector, particularly coffee, which has enjoyed a protected status since the 1930s. Moreover, changing market forces, such as the consolidation of wholesale and retail distributors coupled with technological innovations and changing consumer behavior, have dramatically transformed in less than a decade the way in which food business is conducted on the island and the market share of local agriculture in the total food trade. To maintain and regain part of agriculture's competitive position, research must be directed to the analysis and managed solution of problems stalling production, and to the search of alternative uses and markets for our products. In the

long term, the goal of our natural and social science research program is to contribute to Puerto Rico's sustained growth and development through technological and policy recommendations that can potentially increase competitive production, and raise the employment level of the population.

#### PLANNED PROGRAMS:

##### 1) Milk and Meat Production Systems

The dairy industry has been the main agricultural enterprise of Puerto Rico for more than 20 years. During that period, however, beef production has been steadily declining and poultry production—the leader in the meat category—has suffered marked fluctuations due to financial difficulties and restructuring of processing facilities. According to Department of Agriculture statistics, income from the production of milk (23%) and meat (19%) represents 42% of the 2004-05 Gross Agricultural Income. Of all the meat consumed in Puerto Rico, we produce only 23.3% locally, thus leaving an ample margin for an expanded market for local products. Both milk and meat productions are limited by a lack of efficiency and production quality.

The AES research program in Milk and Meat Production Systems has a wider scope—in terms of commodities and problem areas—than that targeted by our federally-funded research projects. Formula funded research is concentrated in the dairy industry, including forage production systems, and to a lesser degree, in beef cattle. Given our current research and extension resources, the following three priorities summarize what we expect to be the main foci of our program during the next years: (1) Evaluation of feeding systems under tropical conditions for increasing feed efficiency for more milk and meat production; (2) Development and evaluation of management practices for reducing the effect of environmental stress on productivity and reproductive efficiency under tropical conditions; and (3) Development and evaluation of new milk and meat products elaborated with local produce. Our efforts will be geared towards regaining the market lost in the last decade and reducing the amount of imports of these products in our local market.

##### 2) Integrated Management of New and Emerging Pests

One of the areas identified as most problematic by our stakeholders is the one related to the introduction of new pests and diseases in the island. New key pests, weeds and diseases are introduced each year, frequently threatening the integrity of the island's fragile agricultural economy. In addition, constantly evolving production systems pose new challenges to Integrated Pest Management (IPM), as pest complexes change and adapt. In response to these concerns, the federally-funded part of our crop protection program was redirected towards the development of integrated management strategies to deal with non-indigenous species and diseases.

Internal evaluations of the CAS research and education programs indicated that after the retirement of key scientific personnel, knowledge of pest identification and taxonomy had been largely abandoned by the Department of Crop Protection, and there was a change of focus into areas of applied pest control. This situation is particularly severe for insect, nematode, virus, and fungal pests, where a generation of new identification techniques and resources are sadly underutilized. To address this concern we will work towards the development of pest and disease taxonomic expertise and towards establishing a continuous process of strategic evaluation of IPM priorities in consultation with stakeholders. In addition, the AES will continue with its commodity-driven priorities in the areas of pesticide registration, testing of 'reduced risk' pesticides, and validation and development of integrated management of pests and diseases.

##### 3) Plant Genetic Resources, Breeding and Production Systems

Plant breeding and production systems research have been pillars of the AES research program for decades, contributing to the expanded production of many crops for which improved disease-resistant varieties have been developed and to better management practices. Recent evaluations confirm that the CAS has the expertise, facilities, germplasm and breeding lines needed for continued development of improved cultivars, and better field management of many traditional crops.

Germplasm collections of crops of economic importance in Puerto Rico are needed to provide material for propagation for commercial production. New germplasm must be evaluated to identify accessions with traits of economic value. Stakeholders have repeatedly pointed out that the lack of seed availability is an important factor limiting the production of many traditional crops. Plant breeders can develop lines with local adaptation and can respond to the emergence of disease or pest problems. Moreover, the efficiency of production systems of traditional and new crops needs to be improved.

Building upon our strengths, we plan to continue with the introduction of adapted germplasm that can be used to address certain production constraints, and develop new cultivars of crops which can potentially contribute to increasing yield or lowering production costs in a farming system. Research geared towards the development of best management practices (BMPs) for traditional and non-traditional crops in Puerto Rico will also be conducted, along with the needed studies to develop production systems that conserve natural resources, increase efficiency, and promote biodiversity and natural services, such as biological nitrogen fixation.

#### 4) Natural Resources and Environment

Water and soil resources are used intensively in any agriculture production system and there is a dire need for their preservation and conservation. Agriculture is considered in many areas as a major source of contamination, through fertilizer, pesticides residues and soil erosion impacting nearby water resources, and diminishing soil quality. In Puerto Rico sixty percent of the cultivated land is in slopes of more than 20%. Data from the Natural Resources Conservation Service indicate there is a 10% annual erosion rate.

Even though we recognize that agriculture can be a serious pollutant source for the environment, we also recognize the need for more reliable scientific data to support these claims, to quantify the contribution of agriculture in relation to other pollution sources, and to measure the short and long term impact of agricultural operations on the environment.

Although the AES has had an active research program in this area for several years, recent evaluations have indicated the need to restructure the program and narrow its scope for this POW cycle. Research on Invasive Species, formerly under Natural Resources and Environment, has now become a program on its own, and some of the sustainable agriculture projects classified under this area have now been moved to other program areas more related to their objectives. As a result, this revised program will be principally focused in soil erosion, water quality and forest management research.

Forests in Puerto Rico cover around 35% of the island. Because of the abandonment of formerly cultivated agricultural lands, after 1950 forests gradually began to reclaim fields. Recent studies on the regeneration of forests in Puerto Rico suggest that successional patterns on abandoned fields are different from natural disturbances. Exotic species have introduced fire into ecosystems where it was previously absent and have changed successional trajectories. One of the goals of this program is to begin research on forest management in the dry zone of Puerto Rico and on the interactions and effects of exotic species and fire on native forest dynamics.

The ultimate objective of the revised Natural Resources and Environment program is to increase our knowledge of natural resource preservation, management and utilization, without jeopardizing agricultural production and income. Formula-funded research will emphasize during this cycle the conservation and efficient use of water resources, particularly through studies related to microirrigation adoption and irrigation scheduling, and on monitoring of water quality standards through development of improved methods for the extraction and analysis of crop management chemicals. Soil erosion and nutrient transport studies will also form part of our priorities and will be focused on developing soil management practices to minimize problems of poorly drained upland soils, and on the evaluation of micronutrient behavior in highly weathered soils.

#### 5) Agricultural Economics, Marketing, Value Added and Community Development

Farming and rural community development in Puerto Rico continues to face constant challenges. The agricultural sector's contribution to the Gross Domestic Product is less than 1%. Even considering the rate of inflation over the last two decades, the Gross Agricultural Income has increased at an annual rate of 0.5% only since 1990. During the last two decades the agricultural land base of the island experienced dramatic reductions, as part of its acreage was converted to alternative urban development uses. In structural terms, significant declines have also occurred in the number and amount of land controlled by mid-sized (50-259 acres) and low sales (\$2,550-\$9,999) farms. Given these trends, it is reasonable to expect continued production problems in most commodities, and a decline in production efficiency.

As globalization continues to restructure local wholesale and retail distribution outlets, remaining farmers increasingly complain about fewer markets for their crops, whereas many communities lack enough employment opportunities and have limited access to quality fresh foods. Food imports of most items are also rising, thus confirming the poor competitive position of local products vs. imported. The examination of these conditions and related trends is vitally important for the development of local agroindustries with the potential of improving community employment, and for strengthening the marketing and overall situation of our agricultural and livestock commodities. Puerto Rico needs to diversify the basis of its economic model, and a community-oriented agricultural development strategy is an option that should be incorporated into this plan. In this POW,

priority will be given to studies of economic efficiency, marketing, new markets, and community agricultural development. Both research and extension faculties will be involved in all aspects of the program.

**Estimated number of professional FTEs/SYs to be budgeted for this plan.**

Year	Extension		Research	
	1862	1890	1862	1890
2007	0.0	0.0	44.2	0.0
2008	0.0	0.0	44.2	0.0
2009	0.0	0.0	44.2	0.0
2010	0.0	0.0	44.2	0.0
2011	0.0	0.0	44.2	0.0

**Merit Review Process**

**The merit review process that will be employed during the 5-Year Plan of Work cycle**

- Internal University Panel
- Expert Peer Review

**Brief explanation**

There has been no significant change in our Program Review Process since our Two-Year update was submitted. Last year, however, we changed the way in which our Hatch-funded research proposals are initially granted. In response to internal and external evaluations requesting that a portion of Hatch funds be allocated to projects on the basis of an annual call for proposals with the year's revised priorities, part of our formula-funded research is now competitively granted on the basis of said proposals. More specifically, the scientific peer review process of Hatch proposals is the following:

An annual call for proposals which includes the year's revised research priorities is prepared and distributed by the AES Research Office. Proposals are submitted to the Assistant Dean for Research with the preliminary endorsement of the respective Department Head. The Assistant Dean for Research sends the proposal again to the corresponding department head, to a local peer reviewer and to an external reviewer for their written comments on the scientific merit of the proposed research and compliance with the AES strategic plan. Proposals and their reviewers' input are discussed and evaluated by the CAS Associate and Assistant Deans for Research, and a final decision is taken by the administration. Project directors of the selected proposals are given the opportunity to incorporate reviewers' suggestions and make adjustments as appropriate. These proposals are then sent to the USDA-CSREES Office of the Administrator, where the respective national program leaders review them. Once the proposals are approved in Washington, the new or revised projects are included in the AES research program.

**Evaluation of Multis & Joint Activities**

**1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?**

{NO DATA ENTERED}

**2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?**

{NO DATA ENTERED}

**3. How will the planned programs describe the expected outcomes and impacts?**

{NO DATA ENTERED}

**4. How will the planned programs result in improved program effectiveness and/or efficiency?**

{NO DATA ENTERED}

**Stakeholder Input****1. Actions taken to seek stakeholder input that encourages their participation (Check all that apply)**

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals

**Brief explanation.**

Two types of meetings are held in different locations of Puerto Rico to identify critical issues that should be targeted by our research program, and to incorporate stakeholder input on these issues and on the setting of research priorities. First, we will continue to celebrate an annual meeting with all the researchers, extension faculty, farmers and other public interested in the work performed under each program and commodity area. In these meetings the progress of currently active projects is discussed, preliminary results are shared and further input is sought for updating research needs and priorities. The meeting is usually celebrated in the Research Center or Substation closest to where the main nucleus of the commodity producers are located, and coordinated with the Agricultural Extension Service commodity specialist and agricultural agents of the region. Both the commodity leader and the extension personnel identify and invite interested stakeholders from producers associations, individual farmers, faculty and students, government officials, and community organizations with an interest in the commodity's work and related research programs. The input received in these meetings from all the stakeholders present is summarized, evaluated and presented in a concluding meeting of commodity leaders, program coordinators and research administrators, where final decisions are taken. The list of priorities assembled through this process guides the year's call for proposals for new Hatch and Special projects.

Second, commodity leaders, program coordinators and directors of integrated academic departments will continue to organize thematic workshops, seminars, and field days where research results on particular topics will be shared and alternative views on the subject—including further research and extension needs, or public policy determinations—will be discussed.

**2(A). A brief statement of the process that will be used by the recipient institution to identify individuals and groups stakeholders and to collect input from them****1. Method to identify individuals and groups**

- Use Advisory Committees

**Brief explanation.**

Stakeholders are identified through commodity leaders, extension personnel and through local advisory committees established by administrators of the CAS.

**2(B). A brief statement of the process that will be used by the recipient institution to identify individuals and groups stakeholders and to collect input from them****1. Methods for collecting Stakeholder Input**

- Meeting with traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals

**Brief explanation**

Input from stakeholders is collected at the meetings conducted by commodity and program leaders. Stakeholders are asked about the most critical issues affecting their commodities and localities and about our research priorities. This information is summarized in a report made by the commodity and program leaders.

**3. A statement of how the input will be considered**

- To Identify Emerging Issues
- Redirect Research Programs
- In the Staff Hiring Process
- To Set Priorities

**Brief explanation.**

The input received in these meetings from all the stakeholders present is summarized, evaluated and presented in a concluding meeting of commodity leaders, program coordinators and research administrators, where final decisions are taken. The list of priorities assembled through this process guides the year's call for proposals for new Hatch and Special projects. When there are issues which need to be emphasized, programs are redirected to address these issues. This process may also inform decisions about recruiting new faculty members.

**1. Name of the Planned Program****Milk and Meat Production Systems Resources****2. Program knowledge areas**

- 302 Nutrient Utilization in Animals 50 %
- 307 Animal Management Systems 30 %
- 301 Reproductive Performance of Animals 5 %
- 308 Improved Animal Products (Before Harvest) 5 %
- 306 Environmental Stress in Animals 10 %

**3. Program existence**

- Mature (More than five years)

**4. Program duration**

- Long-Term (More than five years)

**5. Brief summary about Planned Program**

Given the importance of livestock industries in the agricultural economy of Puerto Rico, the AES research program in Milk and Meat Production Systems has a wider scope—in terms of commodities and problem areas—than that targeted by our federally-funded research projects. Formula funded research is concentrated in the dairy industry, including forage production systems, and to a lesser degree, in beef cattle.

Structural analysis of the dairy industry shows that the number of farms has been declining while the average herd size has increased accordingly. The total number of acres dedicated to forage production declined by more than 12% during the last decade. Faced with insufficient land for feed production, farmers are increasingly relying on imported feed sources to feed their lactating cows. To improve the industry's situation, studies will continue or begin in the following areas: (1) Improving the efficiency of nutrient utilization on dairy farms; (2) Supplementation strategies to optimize productivity and efficiency of dairy cows grazing tropical forages; (3) Development of feeding and management strategies to improve dry matter intake and milk production of lactating dairy cows; (4) Defining the physiological characteristics of the heat-stressed dairy cow and improving milk production without decreasing fertility with the use of exogenous enzymes; (5) Pasture renovation strategies to maintain the stability of grasslands; and (6) Identification of potential new grasses and legumes to support the dairy, beef and small ruminant industry.

In the case of beef, decline in production during the past twenty-five years has left the local industry market participation at only 12.7% in 2004-05. Although beef consumption continues to increase, there has never been a quality grading system to offer consumers any kind of quality assurance, and imports keep filling the void left by local production. Very low profit margins for cattlemen contrast with the high retail prices obtained for local and imported beef, reflecting the industry's organizational and structural problems. Former research results suggest, however, that local beef from young bulls—mostly grass-fed and free of added hormones—has numerous nutritional advantages over imported beef. To regain its share of the market, the industry must capitalize on these advantages and launch a promotional effort to increase local beef consumption. On the research side, studies to support this effort will be mostly focused on: (1) Developing economic feeding systems that can decrease slaughtering age of grass-fed cattle; (2) Characterizing the chemical composition and nutritional value of local beef; and (3) Studying, under these production conditions, the relationship between chronological age and tenderness, the most important single determinant of consumer acceptability. The new marketing and production strategies devised should add value and recognition to the local beef, serving in the long term to increase the demand for local production.

**6. Situation and priorities**

The dairy industry has been the main agricultural enterprise of Puerto Rico for more than 20 years. During that period, however, beef production has been steadily declining and poultry production—the leader in the meat category—has suffered marked fluctuations due to financial difficulties and restructuring of processing facilities. According to Department of Agriculture statistics, income from the production of milk (23%) and meat (19%) represents 42% of the 2004-05 Gross Agricultural Income. Of all the meat consumed in Puerto Rico, only 23.3% is produced locally, thus leaving an ample margin for an expanded market for local products. Both milk and meat productions are limited by a lack of efficiency and production quality.

The industries' problems of low production efficiency, low quality of the final product, and little product diversification are compounded by the island's lack of control of imports and by the high cost of production per unit of production in Puerto Rico, resulting largely from the high price of land and feed inputs. Under these circumstances, and given our current research and extension resources, the following three priorities summarize the main foci of our program during the next years:

- § Evaluation of feeding systems under tropical conditions for increasing feed efficiency for more milk and meat production.
- § Development and evaluation of management practices for reducing the effect of environmental stress on productivity and reproductive efficiency under tropical conditions.
- § Development and evaluation of new milk and meat products elaborated with local produce.

Our efforts will be geared toward regaining the market lost in the last decade and reducing the amount of imports of these products in our local market.

## 7. Assumptions made for the Program

Improving the production efficiency and final quality of local meats will help increase the demand for the local product. The institutional funding for new projects and staff needed to conduct this program will be available. Research results on the efficient use of forage and feed resources to increase income over feeding costs, will be translated into management practices that will be widely adopted by the dairy farmers of Puerto Rico. The number of extension agents assigned to work with this program will be adequate to provide direct follow-up to farmers.

## 8. Ultimate goal(s) of this Program

To increase production levels and the capability of local milk and meat products to compete with imports, thus achieving in the long term a decline in the imports of these products. In addition, new legume and grass resources will be identified and assessed for inclusion into conserved forage and pasture-based systems.

## 9. Scope of Program

- In-State Research
- Multistate Research

## Inputs for the Program

### 10. Expending formula funds or state-matching funds

- Yes

### 11. Expending other than formula funds or state-matching funds

- Yes

### 12. Expending amount of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	0.0	0.0	8.4	0.0
2008	0.0	0.0	8.4	0.0
2009	0.0	0.0	8.4	0.0
2010	0.0	0.0	8.4	0.0
2011	0.0	0.0	8.4	0.0



## Outputs for the Program

### 13. Activity (What will be done?)

Organize meetings among researchers, extension service personnel and stakeholders to discuss the situation of the industry and research priorities

Promote the formation of integrated work groups for each area of production

Organize field days in research facilities and/or on private farms to validate and demonstrate recommended management practices (RMP) based on research results

Offer seminars (S) and short courses (SC) to stakeholders for the dissemination of research formulated RMPs

Publish research results in a simpler layout that can be easily comprehended by stakeholders

Publish research results in refereed journals for scientists

### 14. Type(s) of methods will be used to reach direct and indirect contacts

Extension	
Direct Method	Indirect Methods
<ul style="list-style-type: none"> <li>{NO DATA ENTERED}</li> </ul>	<ul style="list-style-type: none"> <li>{NO DATA ENTERED}</li> </ul>

### 15. Description of targeted audience

Farmers, Extension professionals, government personnel, scientists, and private professionals.

### 16. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0

### 17. (Standard Research Target) Number of Patents

Expected Patents	
Year	Target
2007	0
2008	0
2009	0
2010	0
2011	0

### 18. Output measures

### Output Text

Number of meetings held with stakeholders to discuss the industries' situation and research priorities

2007	Target:	4
2008	Target:	4
2009	Target:	4
2010	Target:	4
2011	Target:	4

### Output Text

Number of popular (non-refereed) publications prepared based on research results.

2007	Target:	4
2008	Target:	4
2009	Target:	4
2010	Target:	4
2011	Target:	4

### Output Text

Number of field days held in research facilities and/or private farms to validate and demonstrate RMPs based on research results.

2007	Target:	4
2008	Target:	4
2009	Target:	4
2010	Target:	4
2011	Target:	4

### Output Text

Number of publications made in refereed scientific journals.

2007	Target:	4
2008	Target:	4
2009	Target:	4
2010	Target:	4
2011	Target:	4

## Outcomes for the Program

### 19. Outcome measures

#### Outcome Text: Awareness created

##### Outcome Text

Number of participants in field days willing to adopt the RMPs demonstrated.

**Outcome Type:** Short

2007	Target:	20
2008	Target:	30
2009	Target:	40
2010	Target:	50
2011	Target:	50

### Outcome Text

% market participation of local beef.

### Outcome Type: Long

2007 Target: 13

2008 Target: 14

2009 Target: 15

2010 Target: 16

2011 Target: 17

## 20. External factors which may affect outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes

### Description

Natural Disasters -

- a) major hurricane – This could affect research by destroying animal confinement structures, causing flooding of research plots, causing delays due to lack of power and potable water.
- b) Outbreak of Brucellosis or “pyroplasmosis”; a recent episode of “pyroplasmosis” caused the death of 15 animals; in addition, sick animals will produce unreliable data.

On the other hand, economic and public policy changes—such as the soon to be implemented CAFTA-DR—by further opening the local market to imports from these countries may affect PR's ability to capture the lost market participation.

## 21. Evaluation studies planned

- Before-After (before and after program)
- Other

### Description

Researchers will periodically evaluate industry indicators compiled by the Extension Service and Department of Agriculture personnel. In conjunction with Extension, researchers plan to conduct a small sample survey of farmers implementing the recommended management practices generated from research results.

## 22. Data Collection Methods

- Sampling
- Observation

### Description

The planned program will use qualitative methods and a small sample survey or case study to collect the data.

**1. Name of the Planned Program****Integrated Management of New and Emerging Pests****2. Program knowledge areas**

- 212 Pathogens and Nematodes Affecting Plants 20 %
- 213 Weeds Affecting Plants 20 %
- 215 Biological Control of Pests Affecting Plants 20 %
- 216 Integrated Pest Management Systems 20 %
- 211 Insects, Mites, and Other Arthropods Affecting Plants 20 %

**3. Program existence**

- New (One year or less)

**4. Program duration**

- Long-Term (More than five years)

**5. Brief summary about Planned Program**

The AES plans to continue with its commodity-driven priorities in the areas of pesticide registration, testing of 'reduced risk' pesticides, and validation and development of integrated management of pests and diseases. In addition, we will work towards the development of pest and disease taxonomic expertise--largely lost after the retirement of scientific personnel from the Department of Crop Protection--and towards establishing a continuous process of strategic evaluation of Integrated Pest Management (IPM) priorities in consultation with stakeholders. To accomplish these goals we plan to (1) enhance and strengthen pest and disease diagnostic capabilities through research, training and participation in related academic programs; (2) gradually develop a Pest Management Strategic Plan (PMSP) for every major crop commodity in Puerto Rico; (3) continue pesticide registration efforts for new pesticides, and begin projects on efficacy testing for registered 'reduced risk' pesticides, including effects on target and non-target organisms, such as natural enemies; and (4) develop integrated research and extension projects which emphasize joint planning, execution and evaluation of IPM strategic priority research.

**6. Situation and priorities**

The nature of tropical agriculture in Puerto Rico is one of a multiplicity of crops, most of these grown on small farms, and in intimate contact with growing urban and suburban populations. New key pests, weeds and diseases are introduced each year into the Island, threatening the integrity of its fragile agricultural economy. Moreover, constantly evolving production systems pose new challenges to IPM, as pest complexes change and adapt. While over the years the AES has developed world-class expertise in the areas of weed science, nematology, and pathology of selected fungi and bacteria, the following factors currently determine the need to refocus the priorities of this new program:

Generalized Lack of Knowledge about Key Pests, Weeds, and Diseases, Including their Management By Producers, Extension Agents, and Personnel from the Department of Agriculture. This lack of knowledge in turn causes the use of unsuitable pesticides, the application of higher doses than needed, increased food residues, increased health risks to farm workers, and has an impact on the environment through water pollution and death of beneficial and non-target organisms. We need to address these environmental concerns and reinforce the use of newer, more environmentally sound crop management methods.

Loss of Institutional Knowledge-Base about the Identity and Biology of Important Groups of Pests. Research on pest identification and taxonomy have been largely neglected after the retirement of key scientific personnel, and following a change of focus into areas of applied pest control by the Department of Crop Protection. We need to strengthen our pest and disease diagnostic capabilities to produce faster diagnoses.

Adoption of Non-Locally Developed IPM Technology without Experimental Validation. The lack of Integrated Pest Management research at the College of Agricultural Sciences has led producers, and extension specialists to use and recommend IPM methods developed elsewhere (usually in temperate regions) and ill adapted to production in the tropics.

Lack of Strategic Approaches to IPM Research. Current circumstances have forced crop protection research to be ad hoc and reactive. Among the advantages of PMSPs are (1) that they take a pest-by-pest approach to identifying needed management practices (chemical and non-chemical); (2) that they are used to set research and education/training priorities; and (3) that they are used to identify the educational programs and the research needed for an effective transition from conventional to alternative pest management practices.

This new program will initially concentrate on areas of strength (such as IR-4 pesticide registration projects and the use of classical biological control), as much as in the development of future direction areas through strategic planning. Priorities can be summarized as (1) fast pest ID and diagnosis; (2) development of PMSPs; (3) testing reduced risk pesticides; and (4) integrated research and extension activities. The goal is to replace reactive research in favor of strategic results-driven research.

## 7. Assumptions made for the Program

The scientists needed to develop this program are available, or will be recruited.

The necessary funds will be available by a combination of internal and external resources.

Research needed to establish the PMSPs for most crops will be conducted.

The input of partners from Extension Service, USDA /APHIS, Puerto Rico's Department of Agriculture and producer groups will be available.

IMP practices suggested in the Pest Management Strategic Plans will be adopted by the producers of the island

## 8. Ultimate goal(s) of this Program

To decrease crop losses due to key and emerging pests and to decrease the damage inflicted upon the environment and health by unsuitable management practices.

## 9. Scope of Program

- In-State Research
- Integrated Research and Extension

## Inputs for the Program

### 10. Expending formula funds or state-matching funds

- Yes

### 11. Expending other than formula funds or state-matching funds

- Yes

### 12. Expending amount of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	0.0	0.0	19.7	0.0
2008	0.0	0.0	19.7	0.0
2009	0.0	0.0	19.7	0.0
2010	0.0	0.0	19.7	0.0
2011	0.0	0.0	19.7	0.0

## Outputs for the Program

### 13. Activity (What will be done?)

Develop partner-mediated PMSPs for the crops of Puerto Rico

Enhance our capacity to conduct fast pest diagnoses

Conduct research on 'reduced risk' pesticides

Foster partner involvement in pest research

Disseminate research results through publications, seminars, field days, conferences, and any other method deemed appropriate to reach our target audiences: Extension Specialists and Agents, Government partners, producers, consumers and environmental groups.

**14. Type(s) of methods will be used to reach direct and indirect contacts**

Extension	
Direct Method	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

**15. Description of targeted audience**

Extension Specialists and Agents;  
 Academic Programs Faculty;  
 Producers and Commodity Groups;  
 Consumers; and  
 Federal and State Agricultural Agencies (PRDA, USDA/APHIS, USDA/ARS, USDA/NRCS).

**16. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0

**17. (Standard Research Target) Number of Patents**

Expected Patents	
Year	Target
2007	0
2008	0
2009	0
2010	0
2011	0

**18. Output measures****Output Text**

Number of 'Pest Management Strategic Plans' (PMSPs) developed

2007 Target: 2  
2008 Target: 3  
2009 Target: 3  
2010 Target: 3  
2011 Target: 4

#### Output Text

Number of peer-reviewed articles in major scientific journals resulting from program activities.

2007 Target: 3  
2008 Target: 3  
2009 Target: 4  
2010 Target: 4  
2011 Target: 5

#### Output Text

Peer reviewed articles in local Scientific Journals resulting from program activities.

2007 Target: 5  
2008 Target: 7  
2009 Target: 8  
2010 Target: 9  
2011 Target: 10

#### Output Text

Abstracts or oral presentations in professional scientific society meetings resulting from program activities.

2007 Target: 8  
2008 Target: 9  
2009 Target: 11  
2010 Target: 13  
2011 Target: 16

#### Output Text

Poster presentations in professional scientific society meetings resulting from program activities

2007 Target: 9  
2008 Target: 9  
2009 Target: 10  
2010 Target: 12  
2011 Target: 15

#### Output Text

Number of joint Research-Extension activities that include pest diagnostics and identification, use of reduced impact pesticides, or research on pesticide impact assessment on non-target beneficial organisms.

2007 Target: 1  
2008 Target: 2  
2009 Target: 2  
2010 Target: 2  
2011 Target: 2

### Output Text

Number of program-sponsored scientific events, like symposia, topic conferences, and open houses

2007	Target:	2
2008	Target:	3
2009	Target:	3
2010	Target:	3
2011	Target:	4

## Outcomes for the Program

### 19. Outcome measures

#### Outcome Text: Awareness created

##### Outcome Text

Number of stakeholders with increased knowledge on emerging pests and aware of non-target pesticide effects

##### Outcome Type: Short

2007	Target:	50
2008	Target:	80
2009	Target:	100
2010	Target:	125
2011	Target:	150

##### Outcome Text

Number of persons that adopted reduced risk pesticides and practices

##### Outcome Type: Medium

2007	Target:	0
2008	Target:	25
2009	Target:	40
2010	Target:	50
2011	Target:	60

##### Outcome Text

Number of farmers reporting decreased losses due to key and emerging pests

##### Outcome Type: Long

2007	Target:	0
2008	Target:	25
2009	Target:	40
2010	Target:	50
2011	Target:	60

### 20. External factors which may affect outcomes

- Natural Disasters (drought,weather extremes,etc.)

#### Description

Puerto Rico is frequently exposed to the impact of hurricanes occurring mostly between August and October. It is possible that increases in the frequency or intensity of hurricanes would favor the introduction of invasive species, and undermine efforts geared towards controlling the impact of key pests.



21. Evaluation studies planned

- {NO DATA ENTERED}

Description

No formal study is planned at this point. However, the program will continue to monitor and document the introduction of pests and their status after IMP are adopted in different regions of the island.

22. Data Collection Methods

- {NO DATA ENTERED}

Description

{NO DATA ENTERED}

**1. Name of the Planned Program**

Plant genetic resources, breeding and production systems

**2. Program knowledge areas**

- 201 Plant Genome, Genetics, and Genetic Mechanisms 25 %
- 205 Plant Management Systems 25 %
- 202 Plant Genetic Resources 25 %
- 203 Plant Biological Efficiency and Abiotic Stresses Affecting Plants 25 %

**3. Program existence**

- Mature (More than five years)

**4. Program duration**

- Long-Term (More than five years)

**5. Brief summary about Planned Program**

Plant breeding and production systems research has been a pillar of the AES research program for decades, contributing to the expanded production of many crops for which improved, disease-resistant varieties have been developed and better management practices have been devised. Recent evaluations confirm that the College of Agricultural Sciences (CAS) has the expertise, facilities, germplasm and breeding lines needed for continued development of improved cultivars and better field management of many traditional crops. Building upon our strengths, we plan to continue with the introduction of adapted germplasm that can be used to address certain production constraints, and to develop new cultivars of crops which can potentially increase yield or lower production costs in a farming system. Research will also be geared towards the development of best management practices (BMPs) for traditional and non-traditional crops in Puerto Rico, along with the studies needed to develop production systems that conserve natural resources, increase efficiency, and promote biodiversity and natural services, such as biological nitrogen fixation.

**6. Situation and priorities**

Germplasm collections of crops of economic importance in Puerto Rico are needed to provide material for propagation for commercial production. New germplasm needs to be evaluated to identify accessions with traits of economic value. The introduction of adapted germplasm can be used to address certain production constraints.

A lack of availability of seed is an important factor limiting the production of many traditional crops. Breeding programs for crops such as pigeon peas, tropical pumpkin, and sweet peppers, do not exist in the private sector or in neighboring countries. Plant breeders can develop lines with local adaptation and can respond to the emergence of disease or pest problems.

There is a need to improve the efficiency of production systems of traditional and new crops. Non-conventional production practices such as hydroponics have unique constraints that need to be addressed with research. Increased mechanization for small-and medium-scale farmers is needed to reduce labor costs. Cropping systems should take advantage of natural services such as the biological control of disease and pests and biological nitrogen fixation.

A re-evaluation of the AES recommendations for traditional production systems is needed (i.e., fertilization and irrigation practices) to provide our stakeholders with recommendations that permit profitable production and natural resources conservation.

Priorities:

Introduction, evaluation and preservation of germplasm and cultivars of crops of economic importance in Puerto Rico

Development of new cultivars of crops of economic importance in Puerto Rico that lead to increased yield or lower production costs or other benefits.

Development production systems that conserve natural resources, increase efficiency and promote biodiversity and natural services.

Development of BMPs for traditional and non-traditional crop production systems in Puerto Rico.

**7. Assumptions made for the Program**

- Long-term financial support for research is needed to permit breeding programs to develop improved cultivars and germplasm, and to permit agronomists to update recommended production practices.
- Scientific personnel with the expertise needed to develop crop cultivars, to maintain genetic resources and to conduct crop production research are available in the College of Agricultural Science.

- A seed program will continue to function to insure the availability of seed of improved cultivars of traditional crops.
- Extreme weather conditions will not destroy field trials, germplasm collections or infrastructure needed to conduct research.

### 8. Ultimate goal(s) of this Program

To achieve wide scale adoption of improved cultivars and production practices that result in greater or more efficient crop production in Puerto Rico.

### 9. Scope of Program

- In-State Research
- Multistate Research

### Inputs for the Program

#### 10. Expending formula funds or state-matching funds

- Yes

#### 11. Expending other than formula funds or state-matching funds

- No

#### 12. Expending amount of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	0.0	0.0	12.9	0.0
2008	0.0	0.0	12.9	0.0
2009	0.0	0.0	12.9	0.0
2010	0.0	0.0	12.9	0.0
2011	0.0	0.0	12.9	0.0

### Outputs for the Program

#### 13. Activity (What will be done?)

Research and release of improved cultivars of crops of economic importance

Electronic publication of descriptions of germplasm collections

Distribution of germplasm to scientists and the public

Publish technology packages describing best management practices for crops of economic importance.

Hosting field days for stakeholders at different Substations in collaboration with the Agricultural Extension Service, and organize field days to seed production fields, germplasm collections and other experimental fields.

Increased on-farm research to validate new technology

Publication of research results in bulletins for farmers and in refereed journals for scientists.

Presentations of research results at scientific meetings

#### 14. Type(s) of methods will be used to reach direct and indirect contacts

Extension	
Direct Method	Indirect Methods
<ul style="list-style-type: none"> <li>● {NO DATA ENTERED}</li> </ul>	<ul style="list-style-type: none"> <li>● {NO DATA ENTERED}</li> </ul>

**15. Description of targeted audience**

Targeted audience consists of farmers, government professionals, county agents, scientists, USDA professionals, and professionals from the private sector.

**16. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0

**17. (Standard Research Target) Number of Patents**

Expected Patents	
Year	Target
2007	0
2008	0
2009	0
2010	0
2011	0

**18. Output measures****Output Text**

Number of stakeholders to adopt the proposed BMPs.

2007 Target: 100  
 2008 Target: 110  
 2009 Target: 115  
 2010 Target: 120  
 2011 Target: 125

**Output Text**

Focus groups of collaborators' opinions of the new technologies being validated

2007 Target: 1  
 2008 Target: 1  
 2009 Target: 1  
 2010 Target: 1  
 2011 Target: 1

### Output Text

The number of "hits" on project-related web sites Records of the sale of hard copies of AES publications.

2007	Target:	1000
2008	Target:	1200
2009	Target:	1500
2010	Target:	1600
2011	Target:	1700

### Output Text

Records of the number and type of germplasm accessions distributed to scientists and the public.

2007	Target:	200
2008	Target:	220
2009	Target:	240
2010	Target:	250
2011	Target:	260

### Output Text

Number of participants in the field days coordinated with Extension

2007	Target:	100
2008	Target:	120
2009	Target:	125
2010	Target:	130
2011	Target:	135

### Output Text

Number of students attending field days to seed production fields, germplasm collections and other experimental fields.

2007	Target:	100
2008	Target:	120
2009	Target:	125
2010	Target:	130
2011	Target:	135

### Output Text

Number of refereed publications

2007	Target:	2
2008	Target:	2
2009	Target:	2
2010	Target:	2
2011	Target:	2

### Output Text

Number of non-refereed publications

2007 Target: 1  
2008 Target: 1  
2009 Target: 1  
2010 Target: 1  
2011 Target: 1

#### Output Text

Number of presentations in scientific meetings

2007 Target: 1  
2008 Target: 1  
2009 Target: 2  
2010 Target: 3  
2011 Target: 3

### Outcomes for the Program

#### 19. Outcome measures

##### Outcome Text: Awareness created

###### Outcome Text

Number of stakeholders to adopt the proposed BMPs

**Outcome Type:** Medium

2007 Target: 110  
2008 Target: 110  
2009 Target: 115  
2010 Target: 120  
2011 Target: 125

###### Outcome Text

Records of the sales of seed of improved cultivars at the Substations.

**Outcome Type:** Long

2007 Target: 100  
2008 Target: 110  
2009 Target: 115  
2010 Target: 118  
2011 Target: 120

#### 20. External factors which may affect outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Competing Programatic Challenges

#### Description

Germplasm collections and field trials related to plant breeding or production research are vulnerable to adverse weather, particularly hurricanes and tropical storms. Some field trials can be conducted during seasons when severe weather is less likely to occur. However, some germplasm collections and field trials need to be planted during the hurricane season. The introduction of an exotic disease or pest could also threaten some crops. The proposed activities in the plan of work are dependent on continued programmatic and fiscal support of the USDA and the Puerto Rico Agricultural Experiment Station.

## 21. Evaluation studies planned

- During (during program)

### Description

Records of seed sales of cultivars developed by the Puerto Rico Agricultural Experiment Station will be maintained at the Substations. These records will provide a measure of the impact of the variety development program.

The Puerto Rico Agricultural Experiment Station web sites containing the crop production technology packages will solicit comments and suggestions from the readers.

## 22. Data Collection Methods

- Other

### Description

Dual moderator focus groups that include farmers, extensionists and researchers will be used to obtain opinions concerning the new technologies being validated. The information from the focus groups will be used to establish research priorities and improve the quality of publications.

**1. Name of the Planned Program**

Natural Resources and Environment

**2. Program knowledge areas**

- 111 Conservation and Efficient Use of Water 20 %
- 123 Management and Sustainability of Forest Resources 20 %
- 112 Watershed Protection and Management 20 %
- 102 Soil, Plant, Water, Nutrient Relationships 40 %

**3. Program existence**

- Intermediate (One to five years)

**4. Program duration**

- Long-Term (More than five years)

**5. Brief summary about Planned Program**

Water and soil resources are used intensively in any agriculture production system and there is a dire need for their preservation and conservation. Agriculture is considered in many areas as a major source of contamination through fertilizer and pesticide residues and soil erosion, impacting nearby water resources and diminishing soil quality. The use of fertilizers and pesticides and land preparation methods turns agriculture into a potential contamination source for water bodies and the soil. Modern agriculture and production techniques must be accompanied by environmental conservation practices in order to maintain a balance among production land, recreational areas for the general public, and forest and wildlife preservation.

Although the AES has had an active research program in this area for several years, recent evaluation results have indicated the need to restructure the program and narrow its scope for this POW cycle. Research on Invasive Species, formerly under Natural Resources and Environment, has now become a program on its own, and some of the sustainable agriculture projects classified under this area have now been moved to other program areas more related to their objectives. As a result, the revised program for this area will be principally focused in soil erosion, water quality and forest management research.

Developing soil management practices to minimize problems of poorly drained upland soils, evaluation of micronutrient behaviour in highly weathered soils, and examination of the adaptability of coffee to acid soil conditions through the accumulation of soil organic matter, are some of the topics to be studied in relation to soil erosion and nutrient transport. Water quality research will continue with work already begun on the characterization of the chemical and biological status of the most important watersheds of Puerto Rico with the objective of establishing the framework for development of a Total Maximum Daily Load (TMDL) for nutrients in different watersheds. Studies to quantify off-field nutrient losses in runoff from tropical agroecosystems and factors influencing their transport are also being conducted. Monitoring water quality standards through research to improve the methodology used for the extraction and analysis of crop management chemicals will also continue. Finally, research on forest management practices to meet the challenges posed by new grass and tree species introduced into the native dry forests of the island will also be developed.

**6. Situation and priorities**

The AES has experienced personnel in the areas of water quality, soil science and forest management. Although in the past, research to address the role of agriculture as a pollutant source has been developed, there is still much work to be done. Agriculture can be a serious pollutant source for the environment, but more reliable scientific data is needed to support these claims, to quantify the contribution of agriculture in relation to other pollution sources, and to measure the short and long term impact of agricultural operations on the environment.

In contrast with mainland US, in Puerto Rico many commercial farmers who require irrigation in their fields adopt microirrigation systems to achieve adequate yields. Microirrigation requires a high level of management to avoid plant stress and yield reductions as water use efficiency increases. Research to determine the irrigation schedule most suitable to the conditions of different crops is therefore needed and remains an ongoing priority of our program. Moreover, given the significant reliance of local producers on crop management chemicals to control diseases and pests, the continuous improvement in the methodology used for the extraction and analysis of these chemicals is vital for monitoring water quality standards and for general ecosystem management.



Forestry research encompasses in Puerto Rico studies geared towards enhancing the adaptation of selected germplasm on highly eroded soils, to improve the fertility status of these soils and reduce their continued erosion. As coffee is an important local crop which used to be grown under an overstory of trees, research on the possible beneficial effects of shading trees on coffee plantations also remains an important component of our federally funded program. In addition, the conservation of forest resources in Puerto Rico calls for studies on the regeneration of forests on the island, since exotic species have introduced fire into ecosystems where it was previously absent and have changed successional trajectories. One of the goals of this program is, therefore, to begin research on forest management in the dry zone of Puerto Rico and on the interactions and effects of exotic species and fire on native forest dynamics.

In summary, the main problems to be addressed by this program are the limitations of water and land in Puerto Rico, and problems associated with soil erosion and conservation of forest resources. Priority areas for this new POW cycle are (1) soil erosion management and nutrient transport; (2) water resources quality and management; and (3) forest management and conservation.

#### 7. Assumptions made for the Program

1. Reasonable funds will be available throughout project duration.
2. Personnel with adequate skills and understating of the subject will be working in the program.
3. Support of related agencies, such as Department of Agriculture of PR, USDA, NRSC, EPA, local Environmental Quality Board and Department of Natural Resources of PR, will be available for the activities proposed and developed.

#### 8. Ultimate goal(s) of this Program

To decrease the presence of pest-related chemicals in the water resources of the island; to increase the efficiency in the use of water on farms with microirrigation systems; to achieve a decline in the number of dry forest fires and an increase in the growth of native dry forest species on the properties of stakeholders; and to reduce soil erosion, improve the fertility of highly eroded soils, and achieve a better root system in shaded coffee plantations.

#### 9. Scope of Program

- In-State Research
- Multistate Research

#### Inputs for the Program

##### 10. Expending formula funds or state-matching funds

- Yes

##### 11. Expending other than formula funds or state-matching funds

- Yes

##### 12. Expending amount of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	0.0	0.0	3.3	0.0
2008	0.0	0.0	3.3	0.0
2009	0.0	0.0	3.3	0.0
2010	0.0	0.0	3.3	0.0
2011	0.0	0.0	3.3	0.0

## Outputs for the Program

### 13. Activity (What will be done?)

Conduct research on microirrigation scheduling, nitrogen-fixing trees, field extraction and analysis of chemical pesticides, soil conditioners for highly eroded soils, and dry forest management in Puerto Rico

Publish research results in bulletins for farmers and in refereed journals for scientists.

Develop educational materials for stakeholders interested in the management and preservation of natural resources and agricultural sustainability

Disseminate research results through publications, seminars, field days, conferences, and any other method deemed appropriate to reach our target audiences

### 14. Type(s) of methods will be used to reach direct and indirect contacts

Extension	
Direct Method	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

### 15. Description of targeted audience

Extension Specialists and professionals, government partners, producers, consumers, and environmental groups

### 16. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0

### 17. (Standard Research Target) Number of Patents

Expected Patents	
Year	Target
2007	0
2008	0
2009	0
2010	0
2011	0

### 18. Output measures

### Output Text

Oral or poster presentations in professional scientific society meetings resulting from program activities

2007	Target:	3
2008	Target:	5
2009	Target:	5
2010	Target:	2
2011	Target:	2

### Output Text

Number of Peer Reviewed publications.

2007	Target:	3
2008	Target:	2
2009	Target:	3
2010	Target:	2
2011	Target:	2

### Output Text

Number of trainings, research demonstration activities and meetings with stakeholders to discuss research results and priorities.

2007	Target:	1
2008	Target:	2
2009	Target:	2
2010	Target:	3
2011	Target:	2

### Output Text

Number of graduate students completing a MS degree and submitting theses under research projects in this program

2007	Target:	4
2008	Target:	2
2009	Target:	2
2010	Target:	2
2011	Target:	2

## Outcomes for the Program

### 19. Outcome measures

#### Outcome Text: Awareness created

##### Outcome Text

Number of stakeholders gaining knowledge on natural resources management, dry forest ecology and management, microirrigation scheduling, and other soil enhancement and water conservation practices

**Outcome Type:** Short

2007	Target:	50
2008	Target:	60
2009	Target:	75
2010	Target:	100
2011	Target:	125

**Outcome Text**

Number of farmers adopting microirrigation management practices

**Outcome Type:** Medium

- 2007 Target: 0
- 2008 Target: 10
- 2009 Target: 20
- 2010 Target: 30
- 2011 Target: 40

**Outcome Text**

Number of persons adopting practices that prevent dry forest fires

**Outcome Type:** Medium

- 2007 Target: 0
- 2008 Target: 0
- 2009 Target: 40
- 2010 Target: 50
- 2011 Target: 60

**Outcome Text**

Number of farmers adopting methods to increase soil organic matter content

**Outcome Type:** Medium

- 2007 Target: 25
- 2008 Target: 30
- 2009 Target: 40
- 2010 Target: 50
- 2011 Target: 60

**Outcome Text**

Number of farmers reporting increased water use efficiency in their farms

**Outcome Type:** Long

- 2007 Target: 25
- 2008 Target: 40
- 2009 Target: 60
- 2010 Target: 80
- 2011 Target: 100

**Outcome Text**

Number of persons that adopted practices to improve water resources.

**Outcome Type:** Long

- 2007 Target: 0
- 2008 Target: 0
- 2009 Target: 40
- 2010 Target: 60
- 2011 Target: 80

**Outcome Text**

Number of fires reported on dry forests

**Outcome Type:** Long

- 2007 Target: 3
- 2008 Target: 2
- 2009 Target: 1
- 2010 Target: 0
- 2011 Target: 0

**Outcome Text**

Number of watersheds for which a Total Maximum Daily Load (TMDL) for nutrients have been developed

**Outcome Type:** Long

- 2007 Target: 0
- 2008 Target: 0
- 2009 Target: 1
- 2010 Target: 1
- 2011 Target: 2

**20. External factors which may affect outcomes**

- Natural Disasters (drought,weather extremes,etc.)

**Description**

Puerto Rico is frequently exposed to the impact of hurricanes and heavy rains that complicate existing problems of soil erosion and nutrient transport, particularly in the central mountain region.

**21. Evaluation studies planned**

- Other

**Description**

No formal study is planned at this point. However, participating researchers will continue monitoring the status of the principal watersheds in the island as part of their ongoing projects' activities.

**22. Data Collection Methods**

- {NO DATA ENTERED}

**Description**

{NO DATA ENTERED}

**1. Name of the Planned Program**

Agricultural Economics, Marketing, Value Added and Community Development

**2. Program knowledge areas**

- 608 Community Resource Planning and Development 10 %
- 610 Domestic Policy Analysis 20 %
- 607 Consumer Economics 10 %
- 604 Marketing and Distribution Practices 30 %
- 601 Economics of Agricultural Production and Farm Management 30 %

**3. Program existence**

- Intermediate (One to five years)

**4. Program duration**

- Long-Term (More than five years)

**5. Brief summary about Planned Program**

Many of the problems faced by Puerto Rico's agricultural sector have already been partially studied under the research program carried out for decades by the integrated research and extension faculty of the Department of Agricultural Economics and Rural Sociology of the CAS. Nevertheless, the continuing challenges faced by farmers and rural communities in Puerto Rico, coupled with the reduced ability of the government to provide increased incentives or subsidies to these sectors because of a current and prospective fiscal crisis, underline the need to conduct more narrowly defined research of topics identified as vital for farming and rural community growth. Studies planned under this program include those that (1) explore new markets for our traditional products, (2) make effective use of marketing tools to exploit products' full potential, (3) explore new uses for conventional products through processing, (4) research the market for "specialty products" as a possible new alternative for our tropical crops, (5) examine efficiency problems at the level of farm management, (6) evaluate the performance of plans and programs implemented in the areas of agricultural economics, marketing, value added and community development, and (7) document the status of community food systems and alternative community agricultural projects.

**6. Situation and priorities**

Farming and rural community development in Puerto Rico continue to face constant challenges. The agricultural sector's contribution to the Gross Domestic Product is still less than 1%, in spite of increased investment by the government in the last five years. Even considering the rate of inflation over the last two decades, the Gross Agricultural Income has increased only at an annual rate of 0.5% since 1990. During the last two decades the agricultural land base of the island has experienced dramatic reductions, as part of its acreage has been converted to alternative urban development uses. In structural terms, significant declines have also occurred in the number and amount of land controlled by mid-sized (50-259 acres) and low sales (\$2,550-\$9,999) farms. Given these trends, it is reasonable to expect continued production problems in most commodities, and a decline in production efficiency. Moreover, as globalization continues to restructure local wholesale and retail distribution outlets, remaining farmers increasingly complain about fewer markets for their crops, whereas many communities lack enough employment opportunities and have limited access to quality fresh foods. Food imports of most items are also increasing, thus confirming the poor competitive position of local products vs. imported. The examination of these conditions and related trends is vitally important for the development of local agroindustries with the potential of improving community employment, and for strengthening the marketing and overall situation of our agricultural and livestock commodities. Puerto Rico needs to diversify the basis of its economic model, and a community-oriented agricultural development strategy is an option that should be incorporated into this plan. During this POW, priority will be given to studies of economic efficiency, marketing, new markets and community agricultural development. Both research and extension faculties will be involved in all aspects of the program.

**7. Assumptions made for the Program**

Better knowledge of production costs, consumers' preferences and local markets will translate into marketing strategies that will allow producers to identify niches to penetrate, and support expanded commodity production.

The institutional funding and staff needed to conduct this program will be available.

The technology needed to increase the physical output of the selected commodities is economically available.

An expansion in the agricultural sector production will improve the employment situation of rural communities

A strong extension component will be developed to translate research results into effective marketing and community

development strategies.

### 8. Ultimate goal(s) of this Program

Increase local, marketable, agricultural production and improve the quality of life and food security situation of households and communities, through the development of economic efficiency and marketing studies of selected commodities (such as plantains, yams, beef cattle and swine), community food system profiles, promotion of community agricultural projects, and identification and documentation of alternative marketing channels for farmers and community production.

### 9. Scope of Program

- In-State Research
- Multistate Research

### Inputs for the Program

#### 10. Expending formula funds or state-matching funds

- Yes

#### 11. Expending other than formula funds or state-matching funds

- No

#### 12. Expending amount of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	0.0	0.0	1.5	0.0
2008	0.0	0.0	1.5	0.0
2009	0.0	0.0	1.5	0.0
2010	0.0	0.0	1.5	0.0
2011	0.0	0.0	1.5	0.0

### Outputs for the Program

#### 13. Activity (What will be done?)

Research to determine consumer preferences, marketing margins, and farmers' and other participant's shares in the marketing channels of selected agricultural commodities will be conducted. Also, studies to identify the diverse strategies local food system stakeholders are currently using or might use to create and manage ongoing or potential change, and their information needs. In collaboration with Extension Faculty and Agents, results will be translated into recommendations for farmers and community organizers. Publications will be prepared and presentations to producers' associations and agricultural professionals will also take place.

#### 14. Type(s) of methods will be used to reach direct and indirect contacts

Extension	
Direct Method	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

**15. Description of targeted audience**

Farmers, Extension professionals, community leaders and organizers, producers associations and other professionals.

**16. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0

**17. (Standard Research Target) Number of Patents**

Expected Patents	
Year	Target
2007	0
2008	0
2009	0
2010	0
2011	0

**18. Output measures****Output Text**

Number of refereed publications

2007 Target: 2  
 2008 Target: 1  
 2009 Target: 2  
 2010 Target: 1  
 2011 Target: 2

**Output Text**

Number of presentations in scientific meetings

2007 Target: 3  
 2008 Target: 3  
 2009 Target: 2  
 2010 Target: 3  
 2011 Target: 2

**Output Text**

Number of non-refereed publications (posters, newspaper articles, etc.)



2007 Target: 2  
2008 Target: 2  
2009 Target: 3  
2010 Target: 2  
2011 Target: 1

#### Output Text

Number of participants attending workshops coordinated with Extension on program's results

2007 Target: 40  
2008 Target: 60  
2009 Target: 75  
2010 Target: 90  
2011 Target: 100

### Outcomes for the Program

#### 19. Outcome measures

##### Outcome Text: Awareness created

###### Outcome Text

Number of stakeholders gaining knowledge about new markets and marketing tools

**Outcome Type:** Medium

2007 Target: 20  
2008 Target: 20  
2009 Target: 80  
2010 Target: 120  
2011 Target: 150

###### Outcome Text

Number of alternative marketing projects identified as existing in Puerto Rico (long-term)

**Outcome Type:** Long

2007 Target: 5  
2008 Target: 7  
2009 Target: 10  
2010 Target: 12  
2011 Target: 15

#### 20. External factors which may affect outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes

#### Description

In Puerto Rico natural disasters such as storms and heavy rains are relatively common. These situations can interfere with data collection, farmers' decisions and consumer priorities. The decisions on what to buy change dramatically after these events. If agricultural production is affected, the supply of fresh foods will be reduced. Also, Puerto Rico is undergoing a period of economic instability in which the capacity of the government to meet its current obligations and service new debt is being reduced. Consumers' attitudes and food preferences may change with the changing economic outlook. Moreover, in volatile economic situations public policy priorities may also shift to meet

new demands, and this may compromise the ability of researchers to accomplish their long term plans.

#### **21. Evaluation studies planned**

- Other

##### **Description**

In the third year of the program (2009) a focus group will be conducted with representatives of program stakeholders to evaluate progress to date and changes that may be implemented to achieve outcomes.

#### **22. Data Collection Methods**

- Other

##### **Description**

In the third year of the program (2009) a focus group will be conducted with representatives of program stakeholders to evaluate progress to date and changes that may be implemented to achieve outcomes.